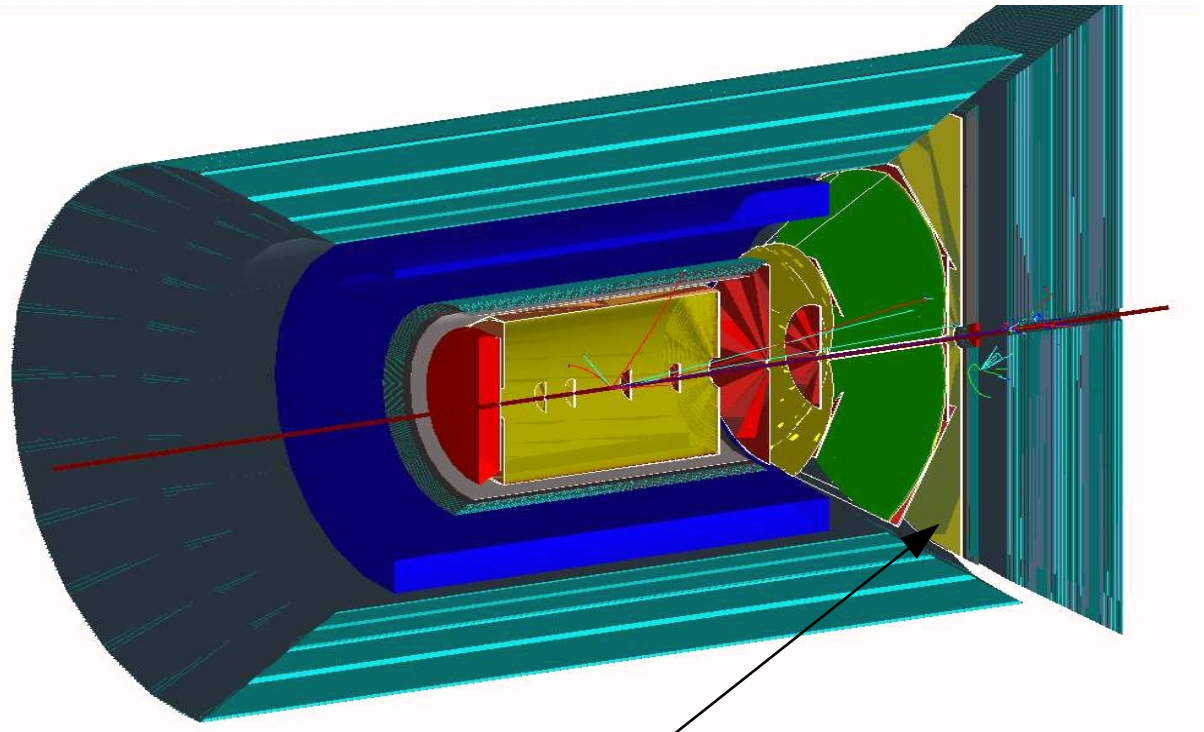# TOF Studies

Yakov Kulinich
02.10.15

Overview

- TOF setup in G4
  - Circular with rinner = 11.4 cm router = 218 cm
  - In z from 310 to 310.1 cm
  - No physical granularity / segmentation
    - Add own granularity. Make detector with rinner = 10 cm router = 210 cm
- G4 Hit has time and position.
  - Took (x,y) and mapped to a "tile"
  - Took tiles of 10x10 and 20x20 cm^2
- Included all charged particles below 10 MeV
- Associated first hit time to all others in same tile

Results

- Calculated number of "bad" multiplicities
  - i.e. in an event, every tile that had more than one registered primary counted as candidate.
  - (badmult / nevents) is the probability in an event that two primaries will enter same tile.
- 10x10 cm^2 case – badmult/nevents = 0.017493
- 20x20 cm^2 case – badmult/nevents = 0.064692
- Makes sense
  - Area increase of 4x corresponds to probability increase of 4x
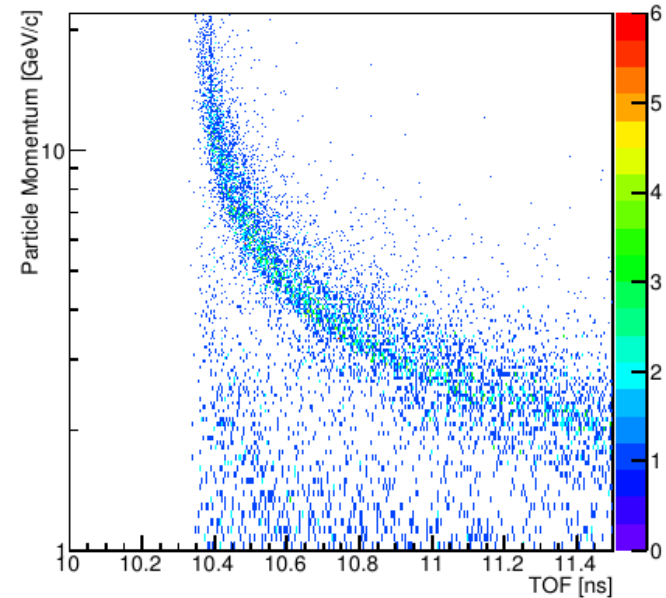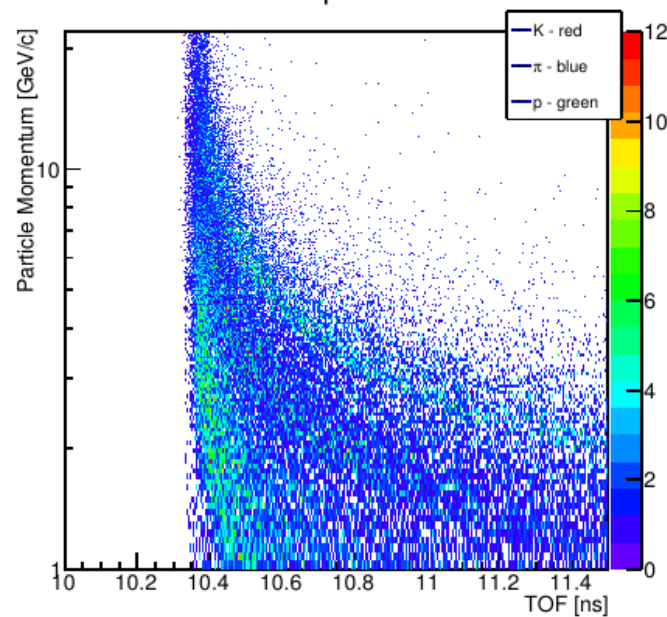
10x10 cm^2   (1.7493%)
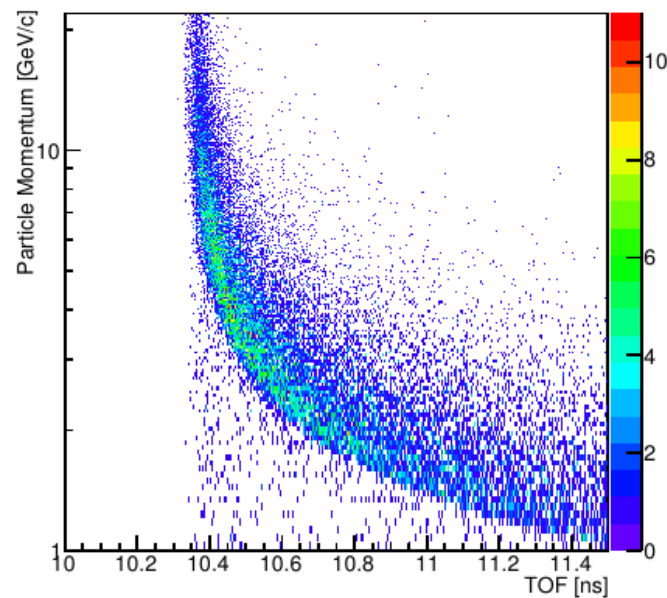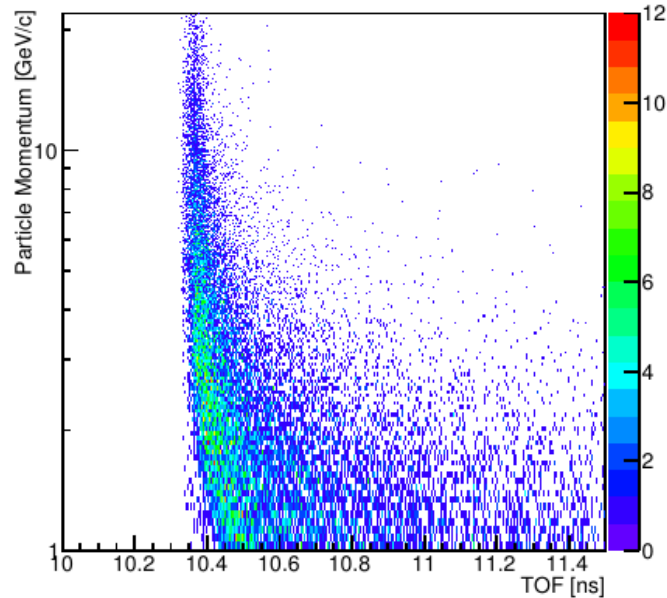
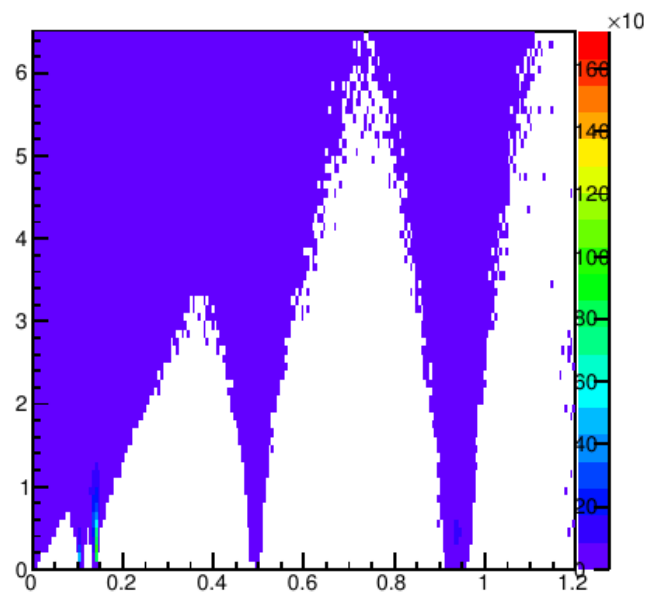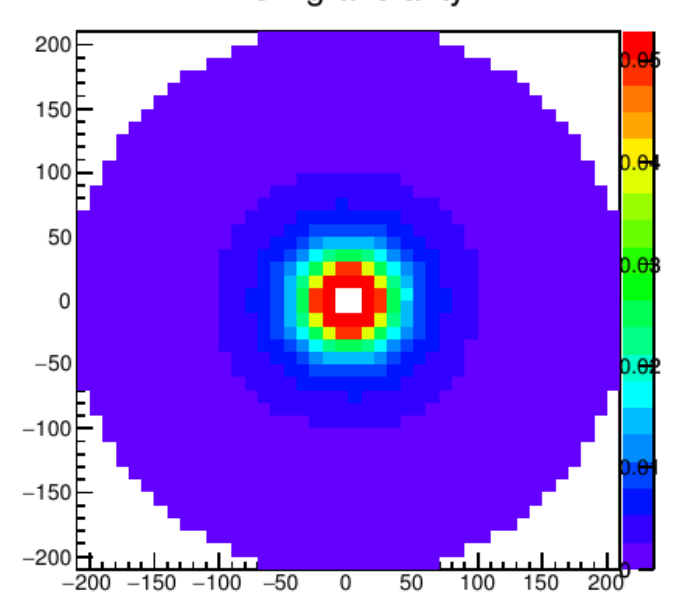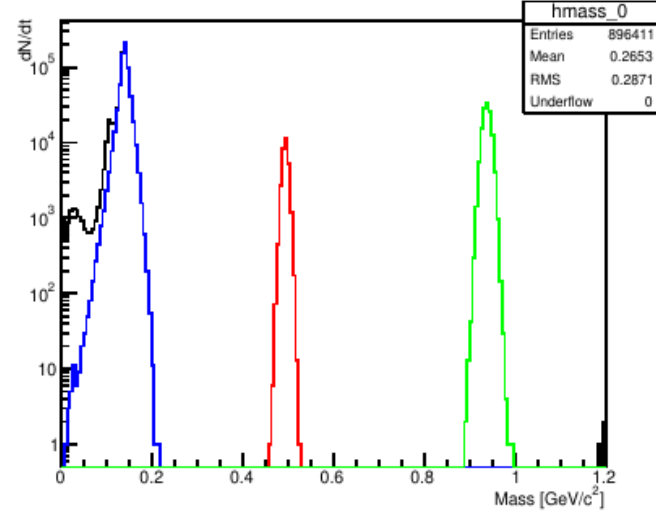# 20x20 cm^2   (6.4692%)
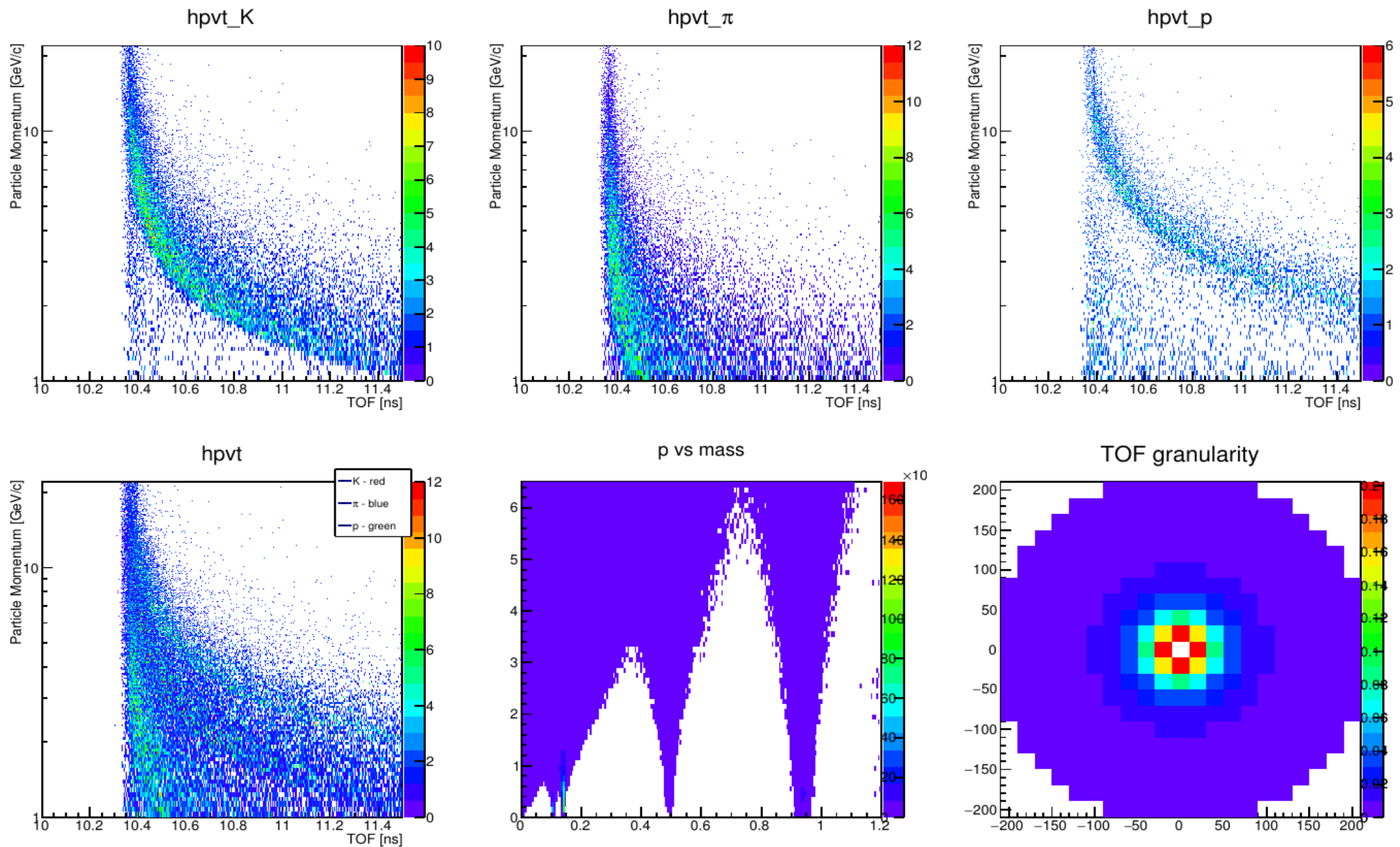
Adjustments Done

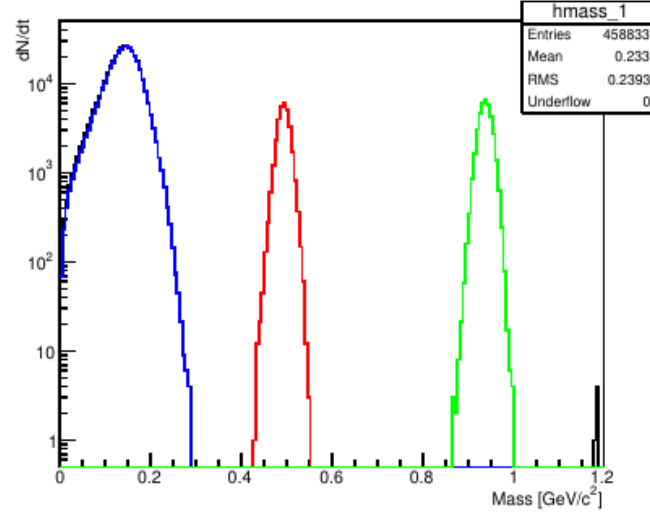- Made center 5x5 – 1 = 24 panels of size 20x20 cm into 10x10 – 4 = 96 panels of size 10x10
  - Energy cutoff 10 MeV (including gammas)
    - Obtained 0.020265 probability of occupancy of primaries
    - Overall 0.230425 probability (including gammas)
    - Primaries come in first, however
  - Energy cutoff 10 KeV (including gammas)
    - Obtained 0.020265 probability of occupancy of primaries
    - Overall 0.644461 probability (including gammas)
    - Primaries come in first, however
- Put cut on distances of traveled particles
  - 1.5 m cutoff gives 0.020264 probability of occupancy of primaries
  - 3.1 m cutoff gives 0.018846 probability of occupancy of primaries
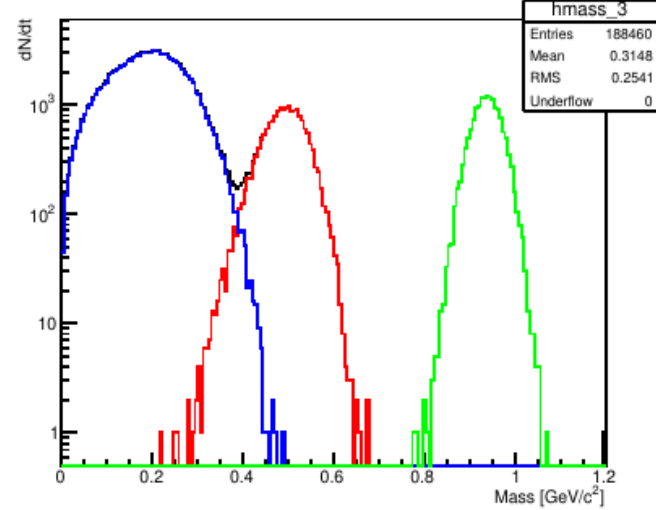
No distance cutoff   (2.30425%)

No distance cutoff   10x10 plus 20x20   (2.30425%)
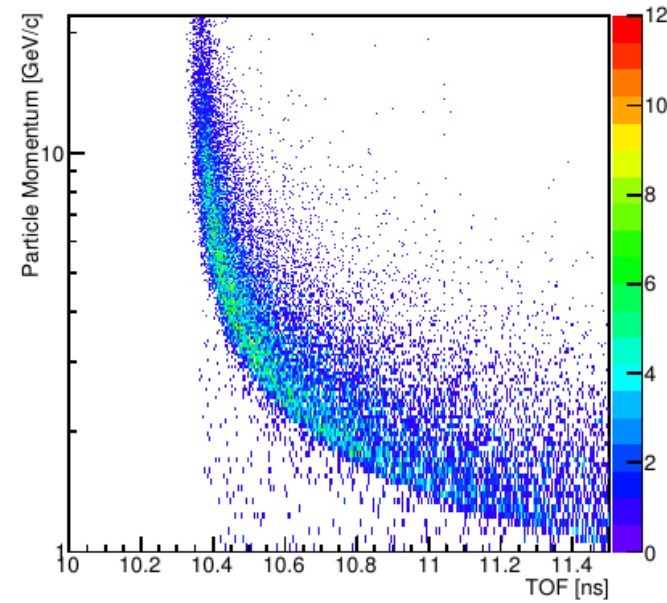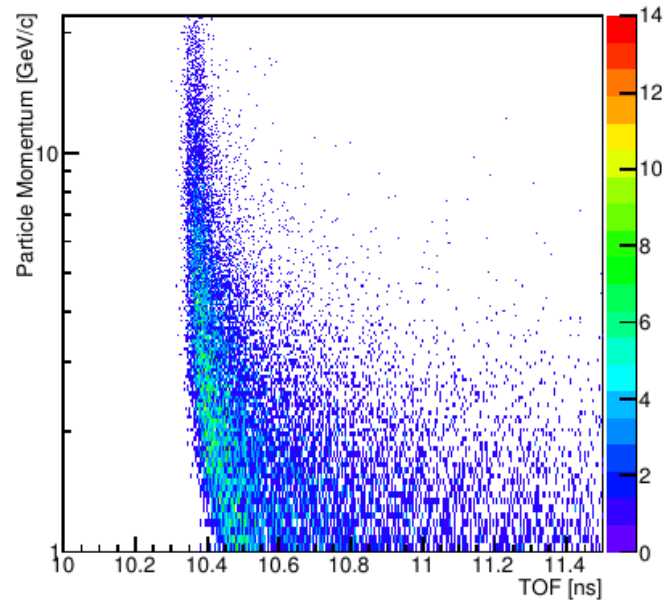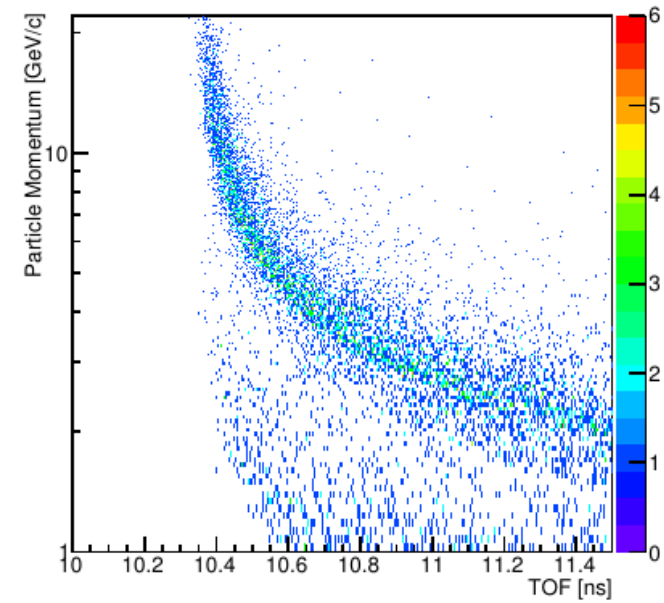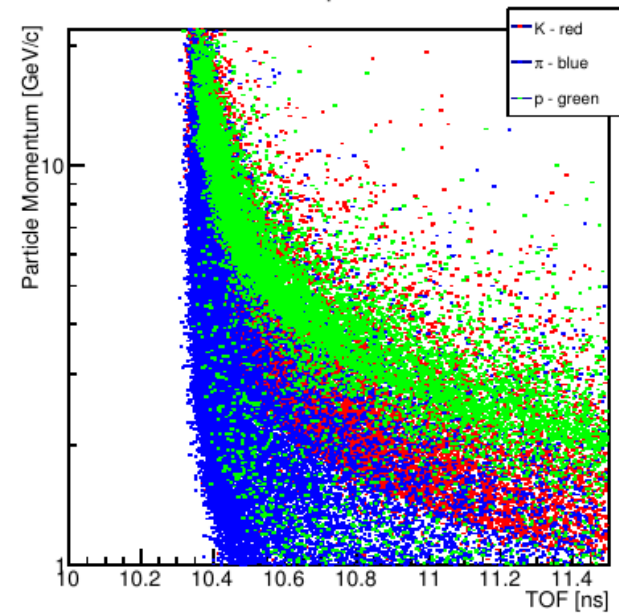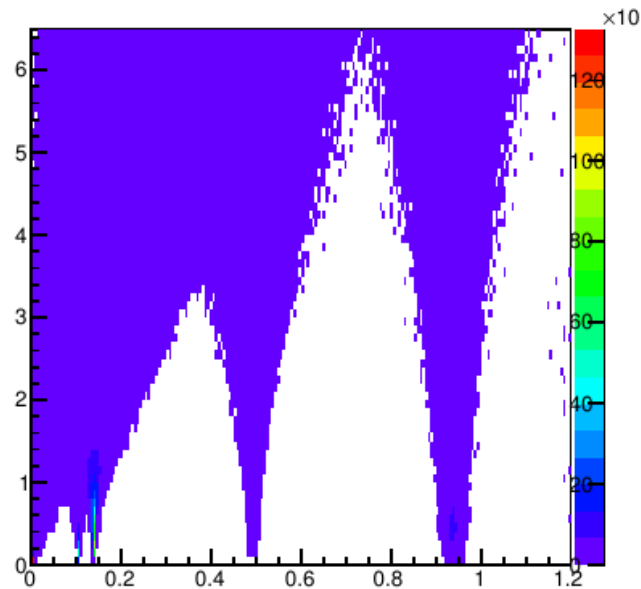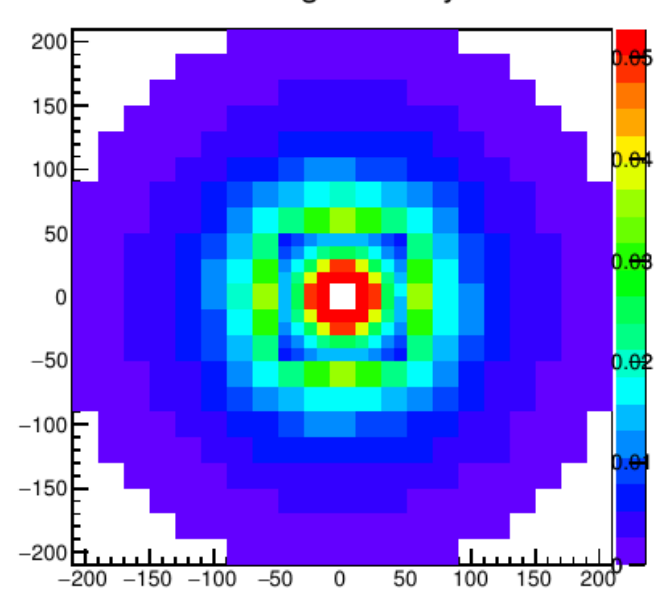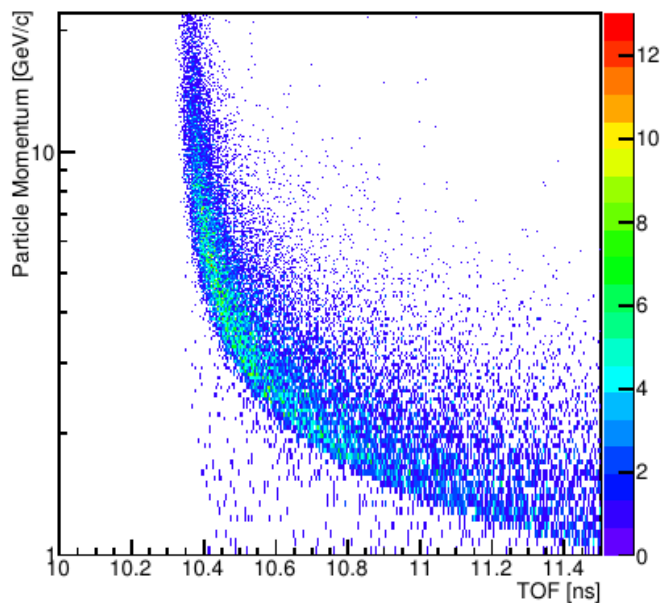
1.5 m cutoff   (2.0264%)
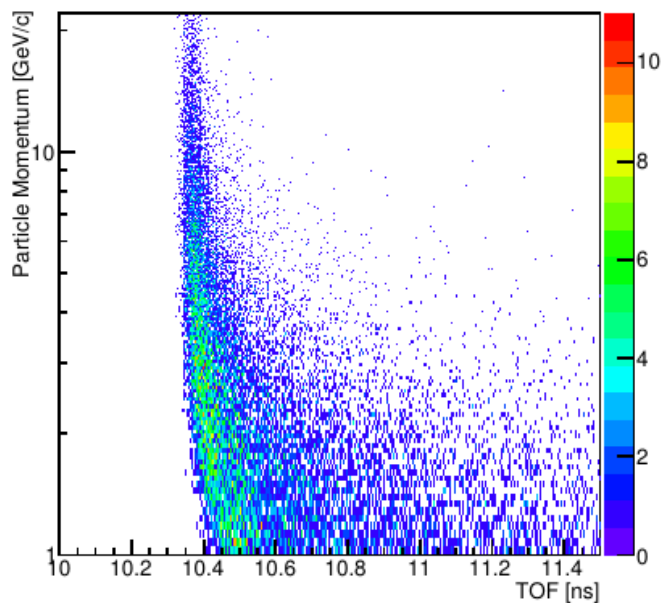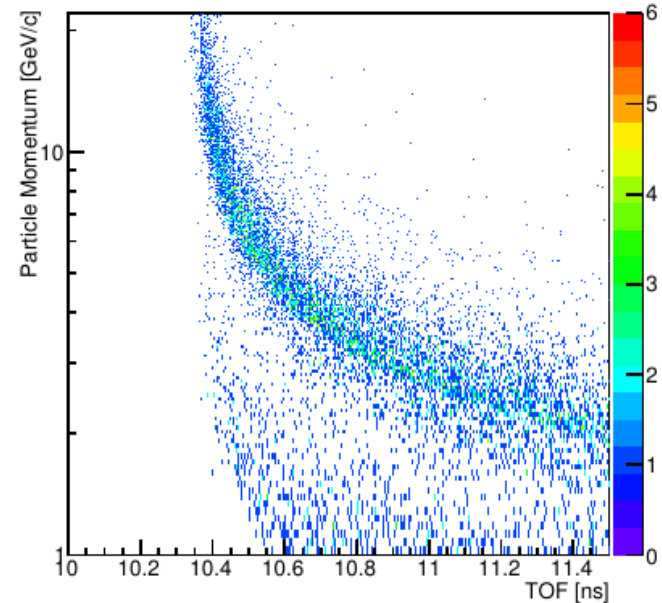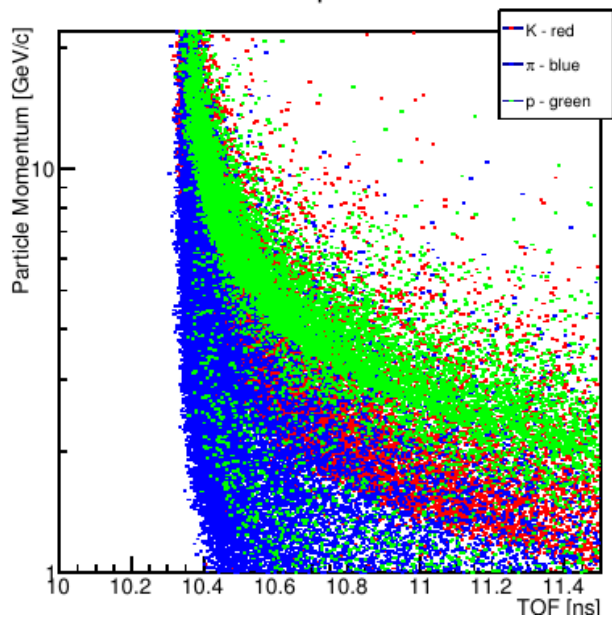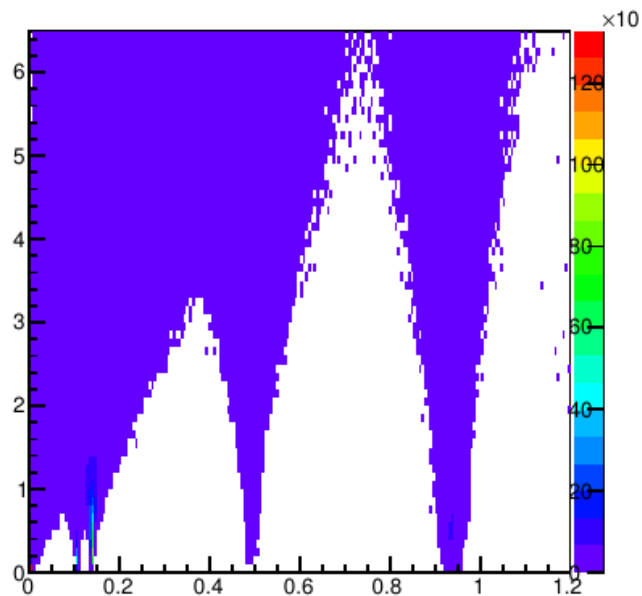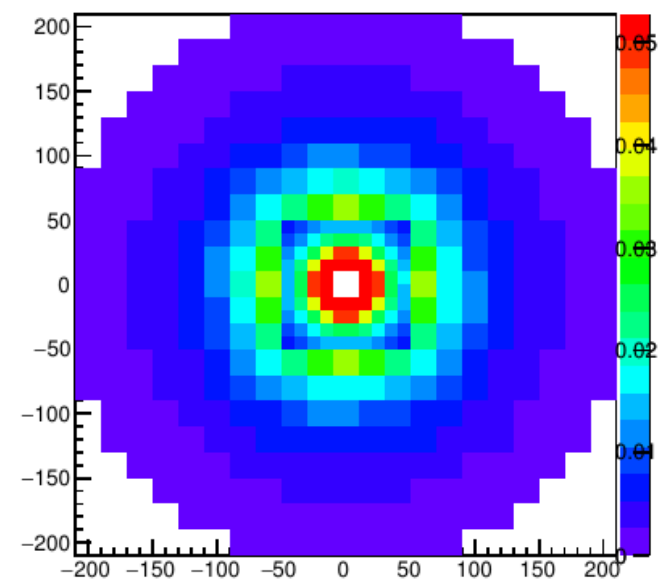
3.1 m cutoff (1.8846%)
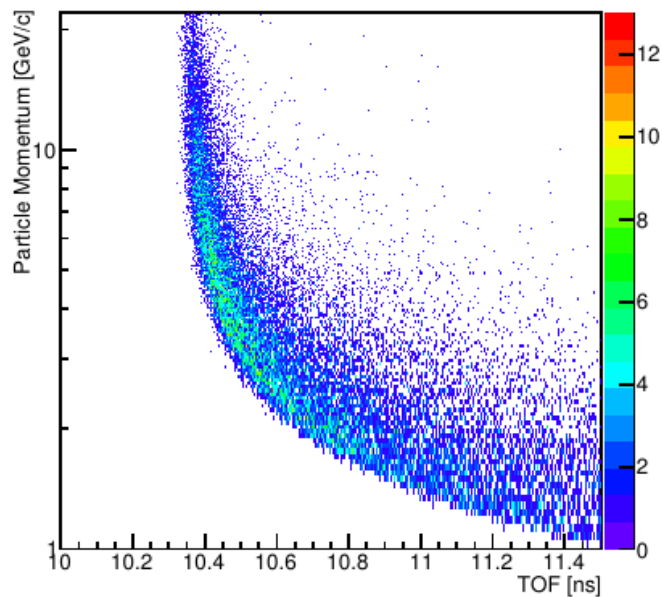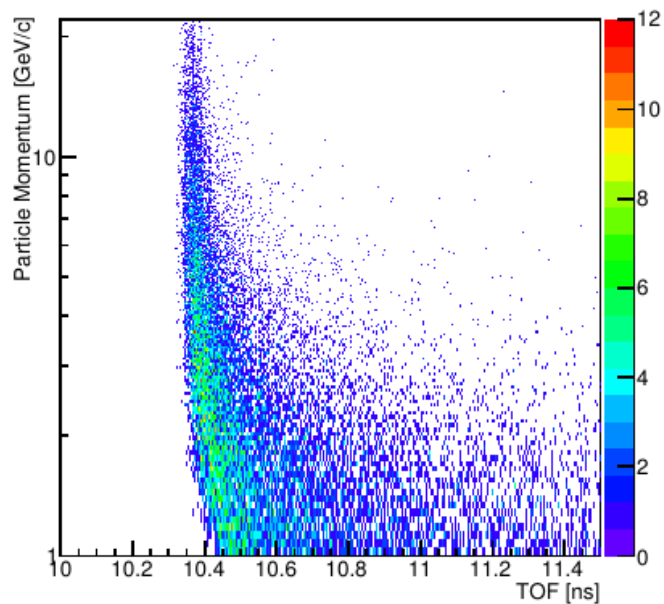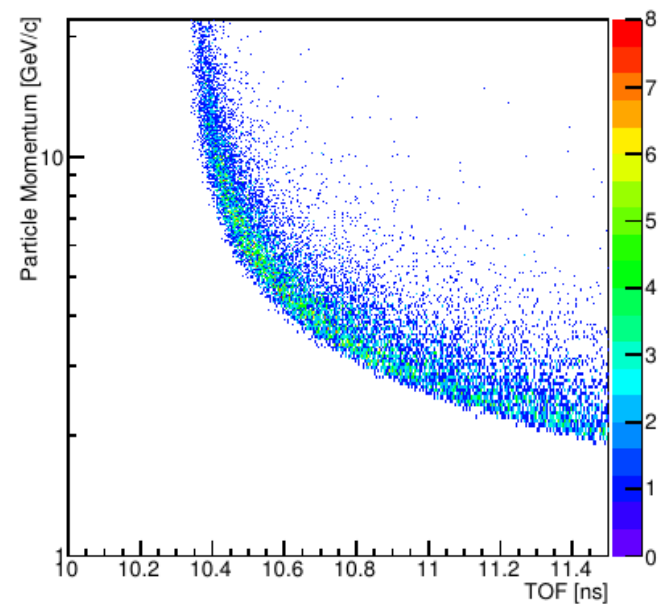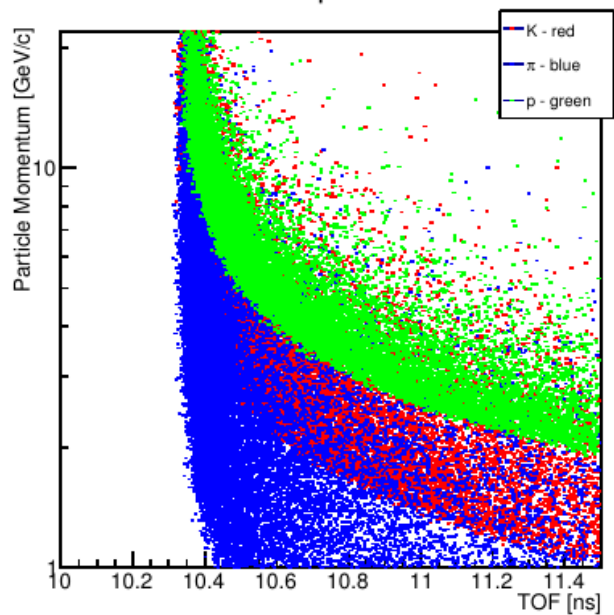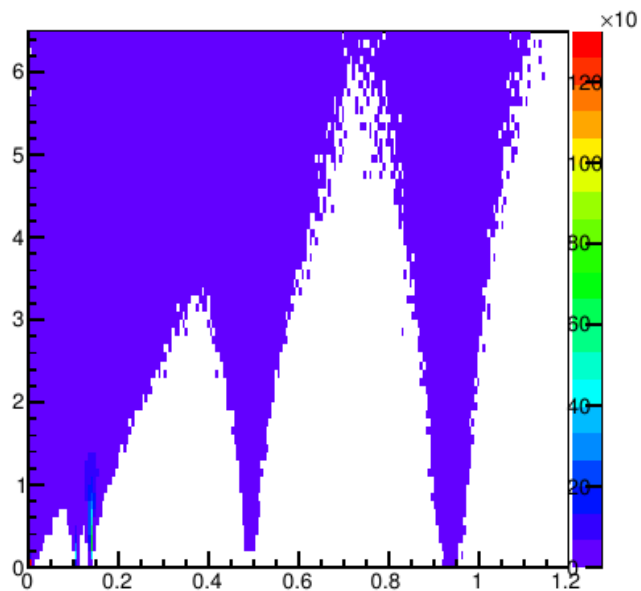
Conclusion

- Particles produced after interaction point, closer to TOF give the low p vs tof points

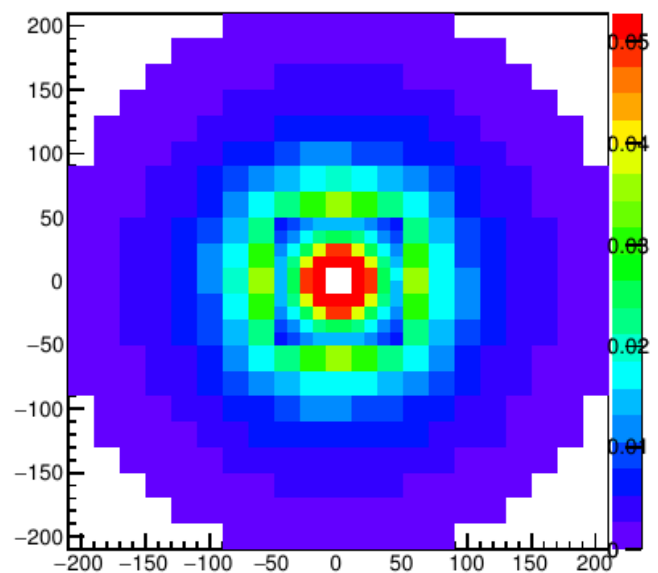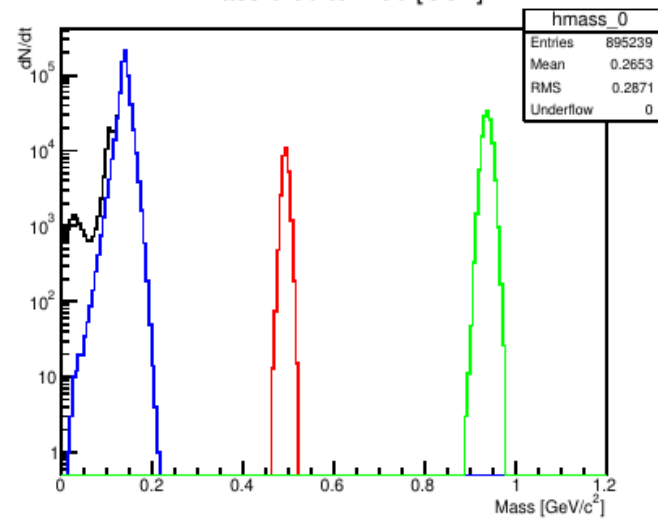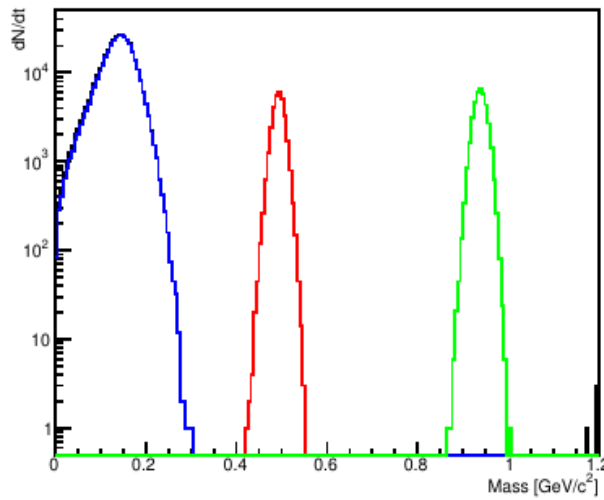- Low energy particles add occupancy (obviously).
  - Produced very close to TOF
    - Make panels 1x1 cm and have 0.236979 probability of occupancy

- Regarding primaries, there is no difference in occupancy
  - They are fast, and higher momentum
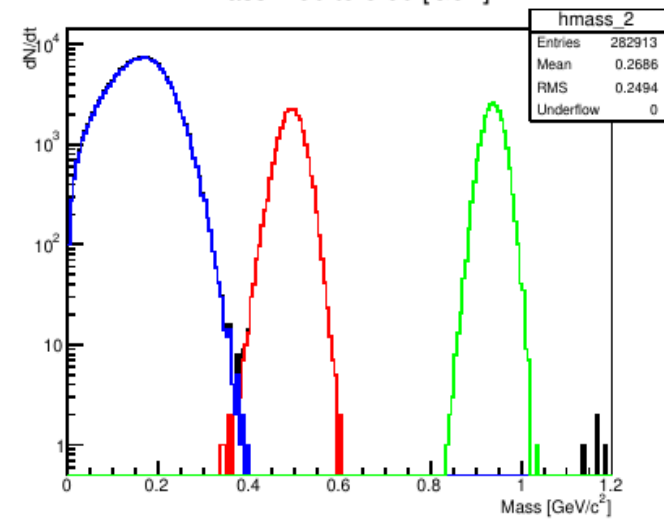
1.5 m cutoff (2.0264%)
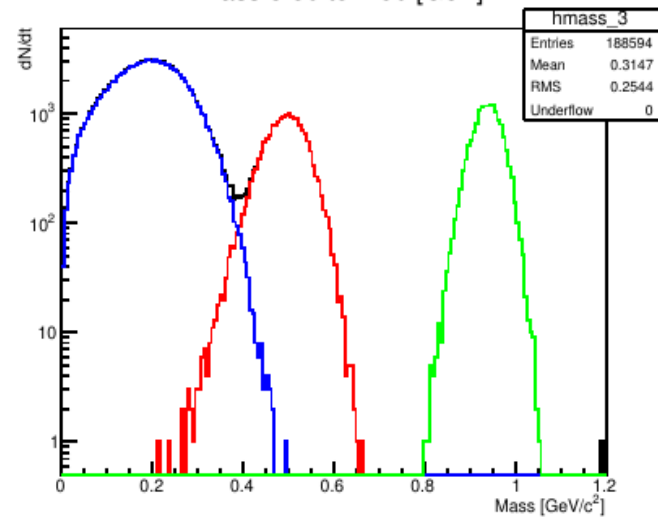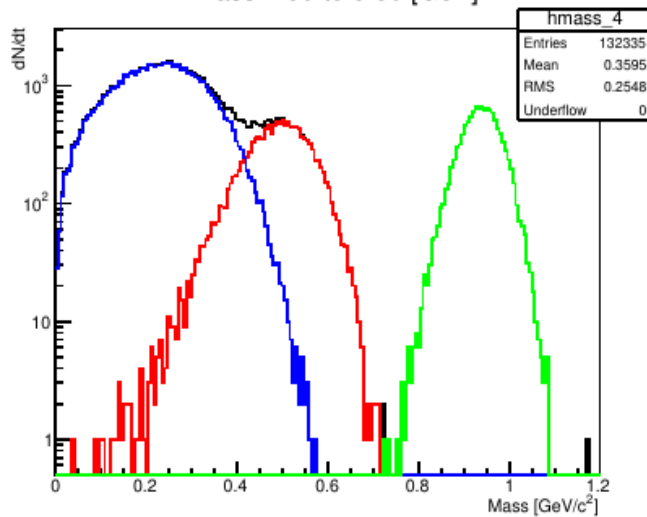

hmass 0.50 to 1.50 [GeV]

hmass_0	
Entries	895239
Mean	0.2653
RMS	0.2871
Underflow	0

hmass 1.50 to 2.50 [GeV]
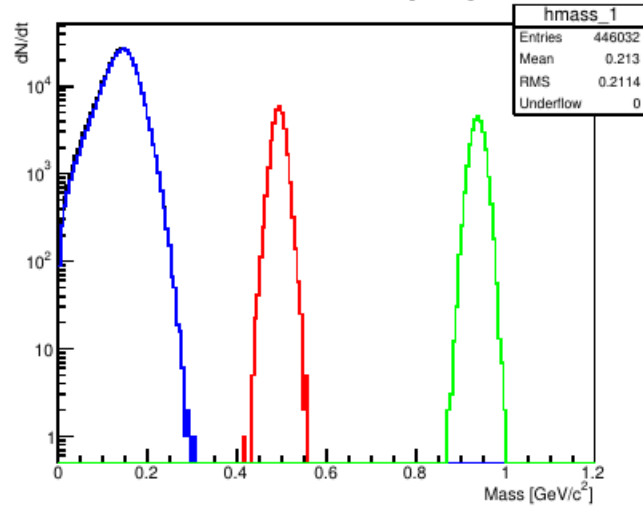
hmass 2.50 to 3.50 [GeV]

hmass_2	
Entries	282913
Mean	0.2686
RMS	0.2494
Underflow	0
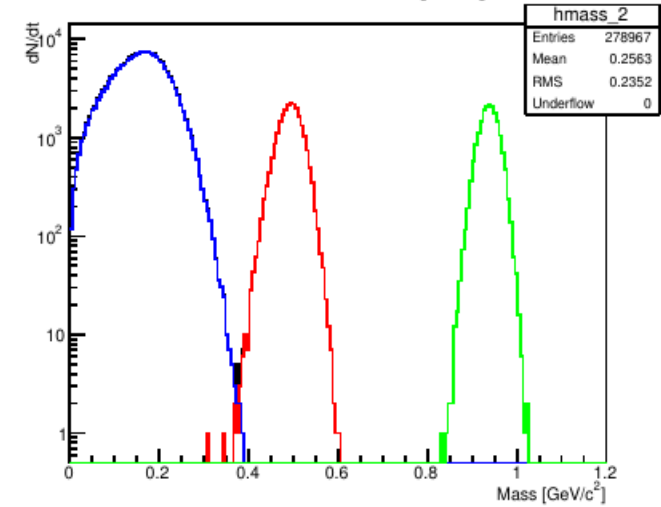
hmass 3.50 to 4.50 [GeV]

hmass_3	
Entries	188594
Mean	0.3147
RMS	0.2544
Underflow	0
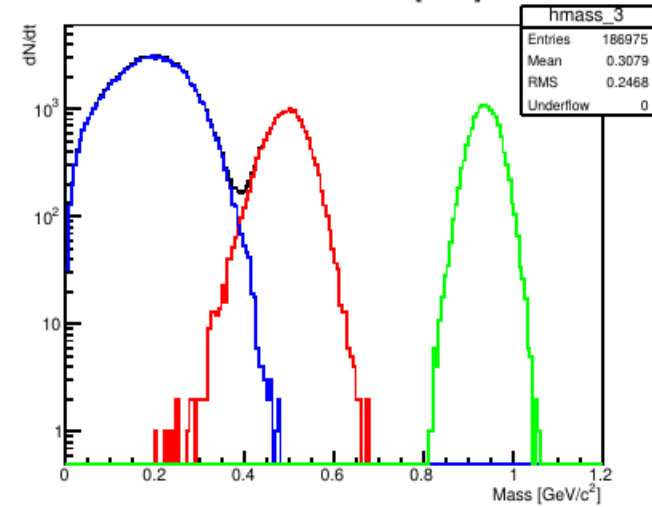
hmass 4.50 to 5.50 [GeV]

hmass_4	
Entries	132335
Mean	0.3595
RMS	0.2548
Underflow	0

hmass 5.50 to 6.50 [GeV]

3.1 m cutoff   (1.8846%)